

61812

Hydrosalpinx.

By

J. Thomson Shirlaw M.B.





Large left hydrosalpinx - Right tube inflamed.

Fig. I.

L.H., aged 32. Had bad confinement 10 years ago. The cervix was lacerated and there was endometritis.

P R E F A C E

In submitting this work as my thesis for the M.D. I must express my great indebtedness to Professor Briggs of the Liverpool University for permission to conduct my research in his Laboratory, for the supply of material, and for kindly allowing me to extract the records of hydrosalpines from his case-books. I also beg to thank Professor Moore of the Bio-Chemistry Department of the same University for undertaking the analyses of the fluids, and confirming any important facts which I had observed concerning these fluids.

Altogether eight specimens of hydrosalpinx were examined, two of haematosalpinx, and two of pyosalpinx, and thirty-seven sections of the walls of these cysts prepared. The sections were stained with haematoxylin-eosin, which was found to give the best results.

The fluids of the hydrosalpines were removed through a sterilised hollow needle, the specimens having been first carefully washed.

The illustrations are taken from original specimens, with one exception, which is stated.

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General remarks :-

Of the fifty-seven cases recorded, all were married, or had borne children, with two exceptions, the average duration of married life being 11.5 years.

The average age of the patients was 33 years and the greatest number of cases occurred between the ages of 30 and 40. The approximate percentages were :-

<u>Between 20 & 30</u>	<u>Between 30 & 40</u>	<u>Between 40 & 50</u>
35%	39%	25%

The age of the youngest patient was 22, of the oldest, 50.

The average duration of the illness was 5 years, the longest duration in any one case being 13 years.

The disease was bilateral in 29 cases, or approximately 50% ; the left tube only was affected in 21 cases or 36% ; and the right tube alone in 7 cases or 13%.

In 10 cases the uterus was fibroid, in 4 there was a pyosalpinx of the opposite tube and in 9 the ovaries were recorded as cystic.

Symptoms :-

The most prominent symptoms, that is those

for which the patient sought relief, were , in the order of frequency, (1) pain, (2) dysmenorrhoea, (3) metrorrhagia.

(1) Pain occurred in the lower part of the abdomen, in the abdomen, back and thighs, or in the back alone. It was of a throbbing, burning, or dragging down character, aggravated by exertion, and relieved by lying down. It was seldom absent and often had exacerbations.

(2) Dysmenorrhoea was severe for a day or two before the period, sometimes necessitating rest in bed. It was relieved when the flow came on.

(3) Metrorrhagia occurred continuously or at more or less irregular intervals.

Other symptoms :-

Intermenstrual discharge was commonly present. It was generally white, but sometimes white tinged with blood, yellow, or brown.

Sterility. Among those who had conceived, the average period which had elapsed since the last pregnancy was 10 years. Some had children and no abortions, some had children and abortions, while others had abortions and no children. The

greatest number of children in any one case was 9, in a woman, aged 49, married 27 years. The greatest number of abortions in any one case, among women who had borne living children, was 5, among those who had not borne children, 9.

Seventeen, or 29%, of the cases were never pregnant, and the particulars are appended :-

<u>Age</u>	<u>Duration of married life</u>	<u>Remarks</u>
1. 28	6 years	Illness began soon after marriage
2. 39	21 "	Fibroid uterus
3. 33	9 "	Ill for 8 years
4. 39	20 "	Fibroid uterus
5. 42	23 "	"Stoppage of bowels" 1 month after marriage
6. 26	1 $\frac{1}{2}$ "	Never been well since married
7. 40	2 $\frac{1}{2}$ "	No definite history
8. 26	6 "	Illness began 3 months after marriage
9. 27	3 "	No definite history
10. 23	3 "	" "
11. 30	5 "	Peritonitis 5 weeks after marriage
12. 26	2 $\frac{1}{2}$ "	Pelvic pain 3 months after marriage, traced to uncured urethritis in husband
13. 23	5 "	Mucous polypus in uterus
14. 35	15 "	Right ovarian cystoma

<u>Age</u>	<u>Duration of married life</u>	<u>Remarks</u>
15. 28	11 years	No definite history
16. 30	6 "	Right tube matted and occluded; left hydrosalpinx
17. 32	9 "	Right abscess of ovary and salpingitis ; left hydrosalpinx.

Nervous symptoms :-

Headache was common. It was most frequently frontal, but sometimes temporal or occipital. Some patients had attacks of giddiness.

Pressure symptoms :-

These were frequency of micturition and pain and difficulty in the act. The rectum did not usually suffer.

Etiology :-

A study of the histories shewed the various antecedents to be as follows :-

Puerperal infection was recorded in 15 cases

Pathological growths of the uterus,
viz. fibroids, mucous polypus and
carcinoma of the cervix in 11 "

Gonorrhea " 7 "

Endometritis for which the
patient had been curetted " 3 "

Attack of pelvic inflammation
variously recorded as "inflammation", "cold in bowels" and
"stoppage of bowels" in 7 cases

Laceration of cervix " 2 "

Prolapsus uteri " 1 case

Operation for ectopic gestation
2 years previously " 1 "

Typhoid fever 10 years previously " 1 "
This case was a left hydrosalpinx, complicated by a right ovarian cystoma.

Of the remaining cases, in one there was a very large ovarian cyst of the right side, and the hydrosalpinx was double - in the others, there was nothing that could be suggested as a possible cause.

Morbid anatomy :-

(a) Macroscopic. The size of the cysts varied - the largest specimen examined being as big as a goose-egg. It measured along the upper curve from the uterine cornu to the site of the ostium $9\frac{3}{4}$ inches, and its greatest circumference was 9 inches. A common size was that of a duck-egg. The colour was pink, or a greyish- or bluish-pink, the shape was that of a retort, but in one case was spheroidal. Smaller specimens were sacculated, while in larger specimens, there

Fig.II



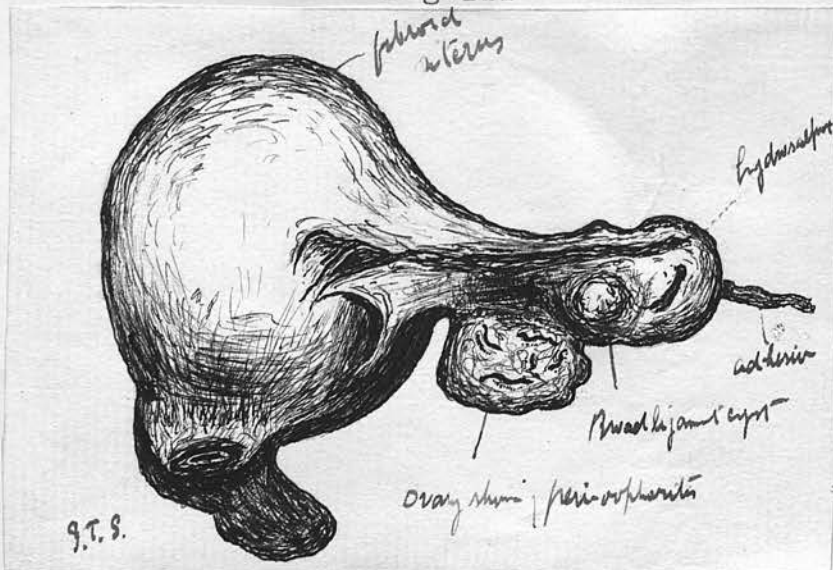
BILATERAL HYDROSALPINX, the tubes have become thin, smooth-walled cysts ; the tubal distension has obliterated the mesosalpinx.

S.P. aged 42 ; 23 years married ; sterile.

History of recurrent pelvic pain in the left side for 10 years.

The photograph is from a specimen in the Gynaecological Museum, Liverpool University.

Fig.III



Drawing of HYDROSALPINX from a case of FIBROID UTERUS.

FIG. IV.



Photograph of post-mortem section illustrating (1) the double hydrosalpinx and the peri-salpingitic adhesions (2) the fixed uterus of pelvic peritonitis and (3) on the fundus uteri, a small semi-cystic fibroid 1" x $\frac{3}{4}$ ".

From the Gynaecological Museum, Liverpool University.

were bulgings in the wall. The diameter of the tube at the distal end was small, but it quickly increased and reached its maximum at the abdominal end; often, however, there was an abrupt increase at the ampullary end of the tube. Sometimes there were two distinct dilatations, a small one in the isthmus, a larger in the ampulla. The cyst, unless it had leaked, was tightly distended, its walls seemed thin and translucent, and small blood vessels were seen ramifying over its surface. Adhesions were sometimes few, one or two being seen on the outer and posterior aspect of the swelling, as if to anchor it to the pelvic wall. The tube and ovary were sometimes distinct, sometimes bound together by adhesions, and in one specimen, tubes, uterus, and ovaries were all matted together by dense adhesions. In the largest cyst, the ovary was crushed and flattened against the posterior wall into the formation of which it seemed to enter. The mesosalpinx was sometimes normal, sometimes thickened, and in the larger cysts effaced altogether.

The ostium abdominale was always closed, and was often not recognisable. In some specimens its site was indicated by a dimple towards which

Fig.V.



Photograph shewing the inner wall of a hydro-salpinx. The plicae are more abundant near the ostium, where an invaginated fimbria can also be seen.

Fig.VI.



Photograph of inner wall of large hydrosalpinx. The plicae appear as thin strands, resembling newly organised lymph. There was no trace of the ostium

furrows converged, as if a purse-string suture had been applied round it and tightened. In one case the ovarian fimbria was partially included in the ostium, forming a kind of plug; in another, the site of the ostium was apparently represented by a "plaque" of dense, white fibrous tissue, the size of a shilling, and of a cartilag^{inous} consistence.

On opening a dropsical tube along its entire length, it was seen that the thickness of the wall diminishes as the diameter of the tube increases : it was thus thickest at the uterine end, and thinnest near the ostium. The thickness varied from one-eighth to one-thirtysecond of one inch. The inner aspect was smooth and glistening, and shewed in some cases small, sessile cysts, about the size and shape of split peas. The flattened plicae were seen running parallel to the axis of the tube, and were more apparent near the ostium. In specimens the size of an orange, they gave the inner wall a rugose appearance, while in large cysts, they appeared as thin strands of fibrous material, almost like newly organised lymph. Correlative with the size of the cyst were the breadth of these

folds of the mucosa, and the extent of their separation from each other. Their breadth varied from one to three m.m. The invaginated fimbriae were sometimes seen at the ostium, their free ends standing out into the interior of the cyst.

The ostium was invariably closed, but in all but one case, there was communication with the uterus, into which a probe could be passed. In the single exception, the cyst, which was spheroidal and formed of the ampulla, was entirely cut off from the isthmus, which was sclerosed, but ^{up to near the cyst.} patent. This struck me as being so unusual that I shewed the specimen to Professor Briggs for confirmation.

Some other cystic condition was ^{almost} invariably associated with hydrosalpinx. Those met with were hydatid cyst of Morgagni, broad ligament cyst, small sub-peritoneal cysts of the outer extremity of the tube, and simple cyst of the ovary.

Microscopic :-

The peritoneal coat shewed badly on section. Adhesions were seen to be made up of connective tissue.

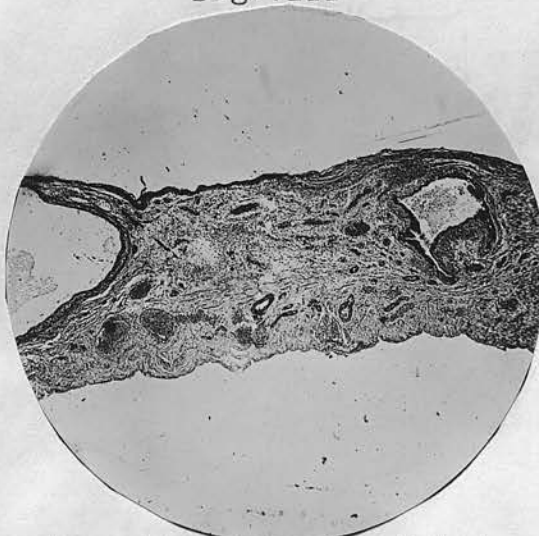
The muscular coat. In one cyst, which

contained 17 c.c's of clear fluid, there was distinct hypertrophy of the circular coat, The Specimen was from a case of fibroid uterus, and Fig.VII



Microphotograph of section of hydrosalpinx from a case of fibroid uterus, shewing hypertrophy of the muscular coat and colloid material in the recesses of the plicae. *Low Power*

the peritoneal coat shewed signs of old inflammation. In most small specimens, the middle coat Fig.VIII

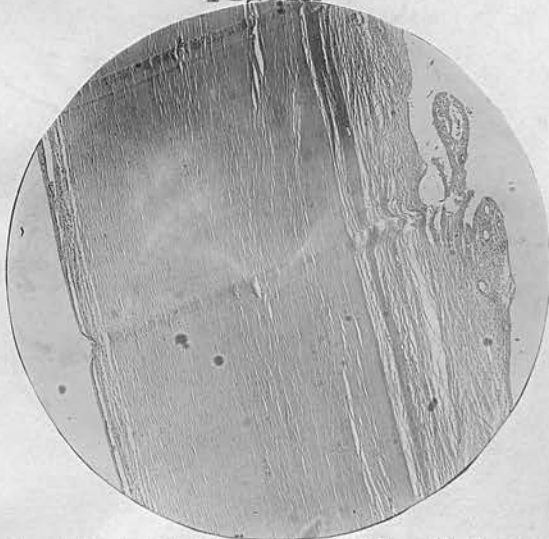


Microphotograph of section of wall of hydrosalpinx from a case of carcinoma of the cervix uteri. The wall is thickened from considerable round celled infiltration and haemorrhage. *Low power.*

was thickened not from hypertrophy of the muscle, however, but from a small-celled infiltration or a connective tissue cell proliferation between the muscular bundles.

Small-celled infiltration was commonly present, and in one case, where the fluid was of a dark, port-wine colour, there were numerous haemorrhages. The original arrangement of the muscular fibres in two layers, could be traced, in all but large specimens, where the middle coat was simply represented by bands of hyaline fibrous tissue, with apparently lymph-spaces between them ; even in these, a section, through the isthmus, shewed both

Fig. IX



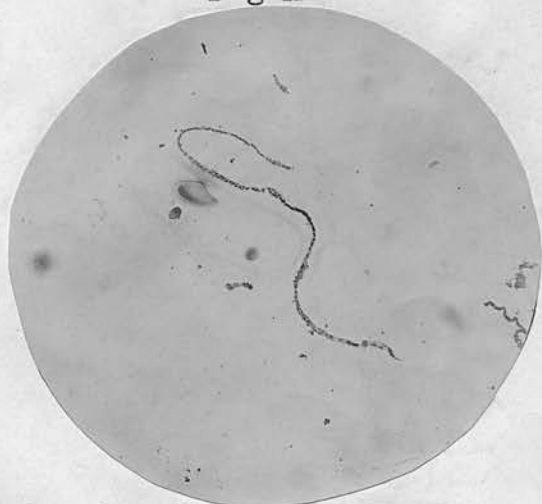
Microphotograph of section of wall of large hydrosalpinx. The wall is composed of bands of hyaline fibrous tissue, with lymph spaces between. *Low Power*

layers of muscle, together with large and numerous

blood-vessels. As the thickness of the wall of the cyst diminished, the more difficult it was to trace the structure and arrangement of the muscular fibres.

Mucous membrane. It was noticed that as the cyst got bigger, the epithelial cells became less and less cylindrical, until in very large cysts, it was represented by a layer of cuboidal cells.

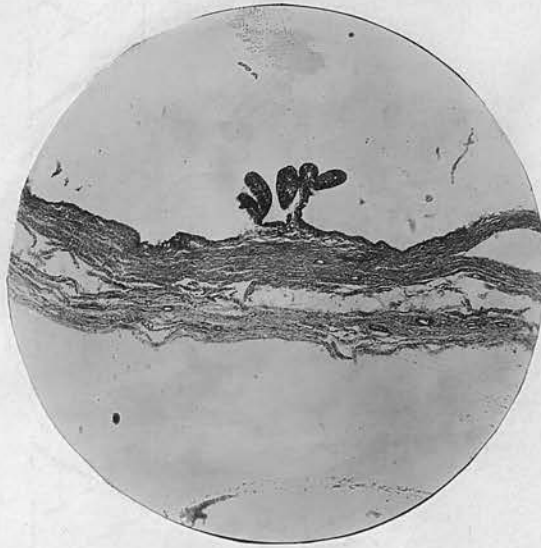
Fig.X .



The-cuboidal epithelium from the inner wall of a large hydrosalpinx. It had become detached in the preparation of the section. $\frac{1}{4}$ "

In no case could the epithelium be called flat. The nuclei of the cells were large. The plicae were shortened. Sometimes they were thick and knobby and projected into the lumen ; at other times, they were long and finger-like, and were folded over on to the cyst wall. It was found that the epithelium of the plicae retained its

cylindrical shape longer than that of the rest of
Fig.XI.



Section of wall of hydrosalpinx shewing "knobby"
plicae and connective tissue cell proliferation
in the wall. *Low Power.*

the mucosa.

In no case was the mucous membrane entirely absent - in the largest cysts some parts of the wall were devoid of epithelium, but this was found to be lying at some distance away, and the separation evidently occurred in the preparation of the section.

In all the specimens examined no cilia could be detected.

The stroma of the mucosa sometimes presented little change - on the other hand, it was often the seat of considerable small-celled infiltration and haemorrhages. Haemin crystals were

occasionally present, and in one hydrosalpinx, which had leaked just before removal, recent haemorrhages were found near the ostium. With the enlargement of the cyst, it was observed that there was a corresponding condensation of the stroma - the stroma of the plicae not sharing to the same extent in the condensation.

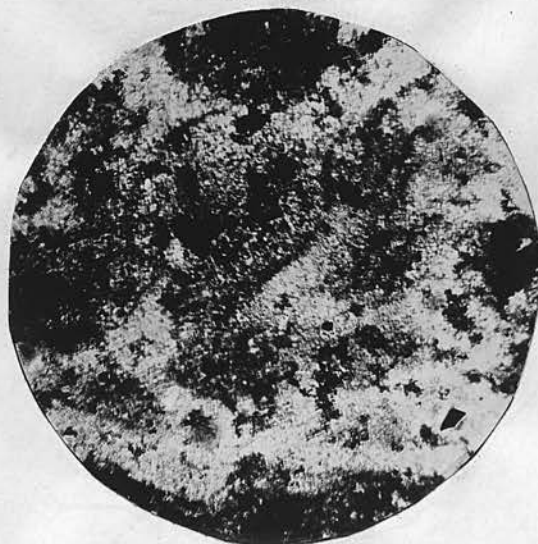
In the lumen, between the plicae, there was occasionally to be seen a peculiar colloid material. This was only found in small specimens.

The contents :-

Three fluids were examined carefully.

No.1 fluid was from a hydrosalpinx where the uterus was enlarged to the size of a six months'

Fig.XII.



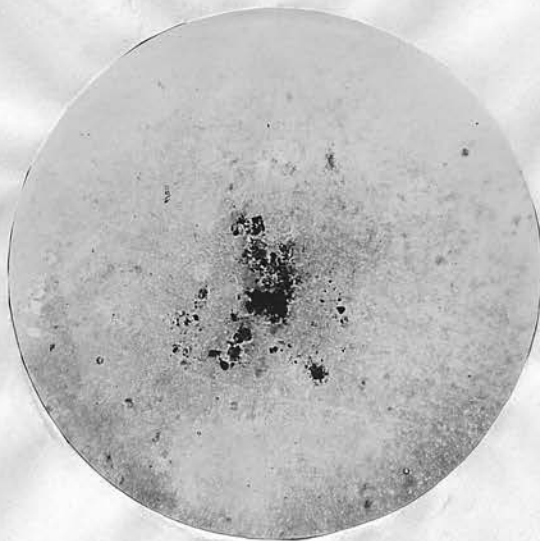
Microscopic appearance of No.1 fluid, shewing feathery crystals of sodium chloride.

foetal head, from fibroid; it was clear and watery, resembling a saline fluid, like the parotid saliva. It had an alkaline reaction and contained no proteid whatsoever. The total amount was 17 c.c's. On analysis, it was found to contain 0.78% total solids of which .64% were inorganic and .14% organic.

When centrifugalised, there was no deposit, but a drop from the bottom of the tube, evaporated to dryness on a cover-slip, shewed feathery crystals of sodium chloride. Before evaporation nothing could be detected microscopically.

No.2 fluid was from a hydrosalpinx where the

Fig.XIII



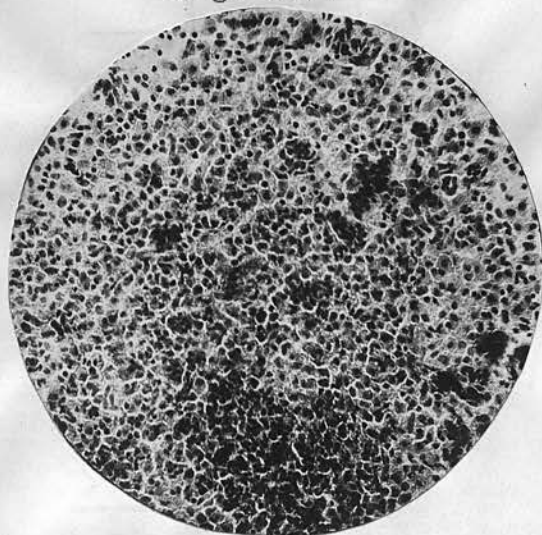
Microscopic appearance of No.2 fluid.

cervix of the uterus was carcinomatous. It was apparently slightly turbid, and this apparent turbidity, Professor Moore considered due to the presence of meth-haemoglobin. The colour was between a chocolate and a port-wine. It was rich in albumen, there being a copious precipitate with heat and nitric acid respectively. The total amount of fluid was 12 c.c's ; the reaction was alkaline and the specific gravity 1008.

Analysis shewed it to contain 2.57% total solids, of which 2% was organic and 0.57% inorganic.

With the centrifuge, there was a visible deposit, which, under the microscope, shewed a few epithelial cells, degenerating red blood corpuscles, granular detritus, and a few blood crystals.

No.3 fluid was from a large cyst, where
Fig. XIV.



Microscopic appearance of No.3 fluid.

Report on Hydro-Salpinx Fluid. (Lily Heyes)

The total quantity was 175 cc.

The fluid was faintly alkaline to litmus & had a specific gravity of 1010. water = 1000.

Total percentage of solids = $\frac{1.511}{1.511 + 1.489} \times 100 = 50\%$

of which _____ \rightarrow 60.5% was inorganic
_____ and _____ 90.6% .. organic

The organic portion consisted entirely of Proteids, the amount given by Kjeldahl's method being equal to 99.2%. The proteids consisted principally of Globulins with small quantities of Albumin + ~~Albuminose~~. Albumoses.

The inorganic portion consisted principally of sodium chloride, e.g. 52.6 % together with traces of Calcium Phosphorus + Potassium. The calcium + phosphorus were not present in sufficient quantity to estimate quantitatively.

B. Moore

the uterus shewed endometritic thickening and the cervix was lacerated.

This fluid was of a pale-buff colour and had also a faintly alkaline reaction. It shewed a moderate amount of albumen with acid and with heat.

I asked Professor Moore to make a complete analysis of this fluid for me and his report is appended:-

Report on hydrosalpinx fluid.

The total quantity was 175 c.c.

The fluid was faintly alkaline, to litmus, and had a specific gravity of 1010 water = 1000

Total percentage of solids	=	1.511%	
of which		.605%	was in-
			organic.
and		.906%	was or-
			ganic.

The organic portion consisted entirely of proteids, the amount given by Kyeldahls' method being equal to .972%.

The proteids consisted principally of Globulins with small quantities of albumin and albumoses.

The inorganic portion consisted principally of sodium chloride e.g. .526% together with traces of calcium, phosphorus, and potassium. The calcium and phosphorus were not present in sufficient quantity to estimate quantitatively.

(Signed) B.Moore.

As I retained 60 c.c's of this fluid for examination, it will be seen that the total amount was 235 c.c's.

There was no visible deposit with the centrifuge, but a drop from the bottom of the tube shewed numerous degenerating epithelial cells with round nuclei, with here and there clumps of cylindrical cells, as if parts of the lining mucosa had been cast off "en masse".

Mucin, although carefully tested for, was absent in all three fluids.

In endeavouring to arrive at the nature of the condition known as hydrosalpinx, one is first struck with the fact that its antecedents, among which the causes must lie, are also the antecedents of endometritis, and of salpingitis. The inference is, therefore, that salpingitis is one of the immediate causes of the disease.

It is easy to see how an infective inflammation of the uterus may spread with facility to the mucosa of the Fallopian tube, as the two membranes are contiguous and present the same uniformity of texture. Moreover, in the tube, there

are all the necessities for an acute inflammation, namely, great vascularity, and ^{ur}textinal looseness and delicacy of the tissues. The first step
Fig.XV.

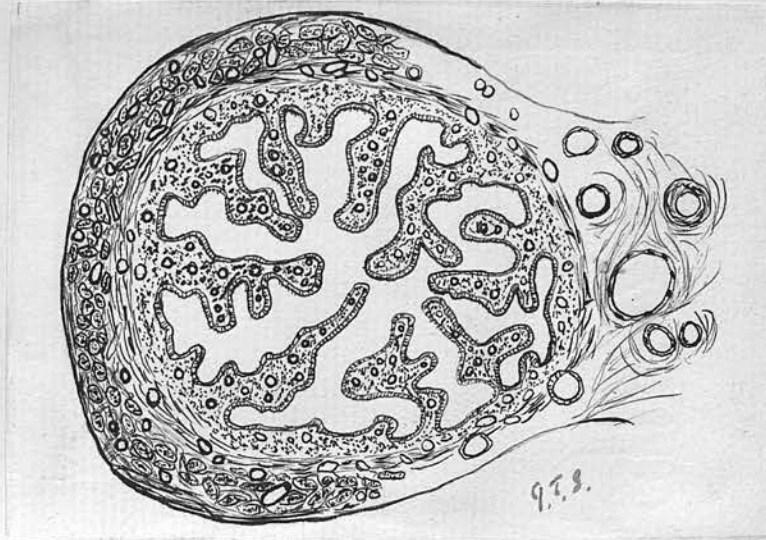


Diagram of a section of the isthmus of the human Fallopian tube, shewing the liberal blood supply. After Quain. (Quain's Anatomy p. 27)

in the inflammatory process is that the tissues of the tube become swollen and oedematous, particularly the middle coat, which, at the ostium, bulges over the fimbriae and encloses them.

The ostium becomes closed by adhesion of the adjacent margins of the inflamed inner coat. This "salpingitic closure" has been clearly demonstrated
1 ^{urine} by Mr. Doran. The ^{urine}ostium ~~uterinae~~, always of small diameter, at the most only from 0.5 to
2
1m/m . wide is blocked on the least provocation, in this case by swelling of the mucous membrane. The oviduct is thus closed. Now, the inflammatory exudate, which soddens the tissues, will flow

more freely in the direction of least resistance namely, into the lumen which, therefore, contains a greater or less amount of serous fluid, according to the degree of stasis. There is, indeed, a very great probability that the exudation is abundant, on account of the vascularity and the slight external resistance of the affected tissues. The inflammation may go on and become so severe as to give rise to complete stasis, and haemorrhage by diapedesis. It is an established fact in pathology that acute inflammations are frequently accompanied by this form of haemorrhage, and that, though as a general rule, white corpuscles pass through the vessels in larger numbers than the red ones, there are some inflammations in which the red corpuscles also pass through in large numbers. The anatomical conditions in the Fallopian tube favour this form of haemorrhage, for there is an abundant blood supply and no other mucous membrane shews such remarkable foldings - these being only supported by a loose stroma of connective tissue. The exudate, then, may be haemorrhagic, and the haemorrhage may be so severe as to form a blood cyst.

I have been fortunate in securing a tube, which was just commencing to be cystic, and where there is little doubt that the condition

arose from an acute salpingitis. The specimen was obtained from a woman (C.H.) aged 42, married 15 years, 1 child, aged 13. Since the birth of the child she had never been well. The right tube was dilated into a thin walled sac, the size of a hen's egg. The left tube was slightly dilated and contained a few c.c.'s of serum. A week or so before the operation, she had an attack of pain in the hypogastrium and passed a single blood-clot. Curettings from the uterus shewed that the glandular elements were normal, but that the connective tissue was denser than usual and shewed considerable round-celled infiltration.

Fig.XVI.



Section of ampulla of normal tube to be compared with Fig.XVII.

Low Power

Fig.XVII.



Section of ampulla of inflamed tube; note the small celled proliferation, the swollen plicae, the velvety mucosa and blood corpuscles in the lumen.

Low Power

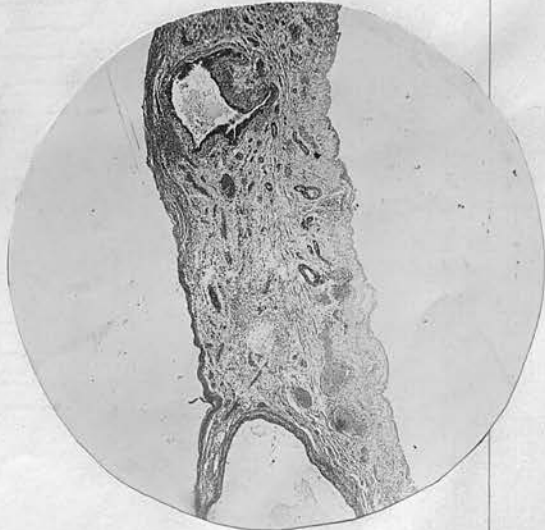
Fig.17 is a microphotograph of a section of the left tube. It is seen that the blood vessels are dilated and that there is round-celled infiltration and haemorrhages into the sub-mucosa. The plicae are swollen and some shew adhesion of their edges. The haemorrhage is seen to be most abundant in the plicae, especially towards their free edges where the stroma of the connective tissue is entirely filled with red blood corpuscles. The corpuscles are also to be noticed lying between the cells of the mucous membrane, being evidently pushed or washed out by lymph, and giving the epithelium a fringed, or velvety, appearance. In the lumen are red and white blood corpuscles beginning to degenerate. A crystal of cholesterin was also present but is not shewn in the photograph.

Fig. XVIII



Low Power

Fig. XIX.



Low Power

Figs. 18 and 19 shew sections of the wall of a hydrosalpinx from a case of carcinoma of the cervix of the uterus. The fluid was described on page 15 - it contained blood corpuscles and was rich in albumen. The vessels are numerous and dilated and some are thrombosed ; there is very considerable round-celled infiltration and haemorrhages are numerous.

Fig.XX.



Section of isthmus of a large salpingitic hydrosalpinx. The fluid contained albumen. Note the numerous and dilated vessels, and the connective tissue cell proliferation. The wall of the ampulla consisted of hyaline fibrous tissue. *Low Power*

Figure 20 is a photograph of a section of the isthmus from the largest case of hydrosalpinx examined. The fluid was No.3, described on page 16. It contained a moderate amount of albumen. There is no evidence of haemorrhage, but it shews signs of old inflammation in dilatation of the blood vessels, and connective tissue cell proliferation.

Figure 12 is taken from a section of the wall of the spheroidal cyst mentioned on page 8. Curettings from the uterus shewed endometritis. It will be noticed that the plicae are still swollen and club shaped - the blood vessels in the wall are dilated and there is abundant proliferation of connective tissue cells. I was unable to examine this fluid, but in the lumen of the tube, on section, granular detritus was present. The fact of the cystic ampullary end of the tube not communicating with the isthmus may be also explained by the acute salpingitis, the adjacent inflamed mucous surfaces having met and cohered. Dr. Herman^{5.} has described a case of hydro- hæmato-salpinx, called by the above compound name because the contents of the sac - bloody serum - might with equal correctness be spoken of as serum, or as altered blood. The swelling was tapped and eight ounces of reddish serum drawn off; microscopically, the thickened

wall was seen to consist of fibro-muscular tissue, the outer part thickly infiltrated with leucocytes. It contained thick walled vessels.

In Rokitansky's Pathological Anatomy⁶; published by the Sydenham Society in 1846, blood pigment is mentioned as having been observed on the inner membrane of the dropsical Fallopian tube, and mingled with its contents.

Now, the inflammatory exudate, whether it be haemorrhagic or not, does not coagulate. Epithelium prevents the formation of fibrine, which is necessary for coagulation. The exudate, therefore, remains in the fluid state, and the inflammation gradually subsides.

The second stage in the development of hydrosalpinx is gradual distension by the accumulation of pent up secretion. But does the Fallopian tube secrete? And if so, what is the nature of the secretion? There are no glands as such in the tube, but glands are, after all, but involutions of a secreting surface in order to increase that surface, and thus the remarkable foldings of the tubal mucosa may be looked upon as glands, the increased surface of the membrane being brought about by elevation, instead of depression. One cannot draw any certain distinction

between the epithelial cells of mucous membranes and so-called gland cells. As covering surfaces, they might all be called epithelial cells and they all, probably, separate definite materials from the blood.

Again, because no mucus has ever been found in menstrual or non-menstrual tubes, or in the fluid of a hydrosalpinx, we cannot infer that the tubal mucosa does not secrete. It is extremely difficult to define the term "mucus" as applied to the secretions of mucous membranes. It is not the same in every situation, for it varies in the nasal passages, in the alimentary canal, and in the urinary bladder and ureters. When we study the act of secretion, it is found that in some cases, the cells give up the substances which they have eliminated, by rupture or deliquescence. Such, for instance, is the mode of secretion of milk, serum and mucus. In other cases, where the secretion is more liquid, containing very little solid matter, or having it in a state of such perfect solution as to be capable of easy transudation, there are no signs whatsoever of any secretory changes in the cells.⁷

The secretion of the Fallopian tube appears to be of this second variety - for (1) exuviation of the cells has not yet been observed and (2) no

mucin has ever been found in menstrual or non-menstrual tubes - nor in the contents of hydrosalpinx. If once present, it would remain, as mucin resists absorption.

An analysis of the fluid of these cysts (page 17) shews that it is practically a watery solution of sodium chloride, the presence of albumen in some of them being due to the serous exudation of an acute salpingitis; Mr. Bond⁸ found that the fluid of experimental hydrosalpinges in rabbits and guinea-pigs contained large quantities of sodium chloride and came to the conclusion that "the natural secretion of the mucosa is a watery fluid."

Doleris and Roulland⁹, as the result of similar experiments, drew attention to the appearance of abundant intra-tubal effusion as soon as occlusion of the fimbriated end of the tube has taken place, and assumed that the mucous membrane must be normally capable of producing a fluid effusion, which, when accumulated, forms a hydrosalpinx.

Having then arrived at the logical conclusion that the Fallopian tube secretes, we have next to consider the question whether the act is a constant one, or occurs only at certain periods. Physiologists inform us that many parts of two ^{offered} mucous surfaces never secrete in the healthy

state, unless under certain physiological stimuli, whereas in others, the membrane is continually moistened by a fluid, varying according to its situation and function. In other words, those parts which are not in perpetual, but only occasional, contact with foreign or secreted substances, seem to shew no secretion, unless stimulated by such contact, while the surfaces of organs like the gall-bladder and urinary bladder, are constantly coated with a quantity of secretion. It is exceedingly probable that the mucosa of the Fallopian tube is continually moistened by a small quantity of fluid, which is poured forth more abundantly on occasions of physiological excitement, such as during menstruation and the passage of the ovum.

It would be most difficult to conceive a more perfect fluid than this faintly alkaline, watery saline secretion, for preserving the vigour of the spermatozoa in their endeavours to reach the ovum, and also of the ovum during its passage towards the uterus.

The secretion, then, scanty during the intermenstrual periods, more abundant during menstruation, is added as it is formed, to the serous exudate already in the lumen, and the tube slowly distends. There occurs, as the distension

goes on, a flattening of the epithelium from pressure, resulting, presumably, in a lessening of the secretory activity. It has, however, been noticed, page 12, that the plical epithelium retains its cylindrical shape longer than that of the rest of the mucosa. The plicae being "puckers" of the mucous membrane, are not subjected to the same distension, which falls more on the underlying muscular coat. Their epithelium, therefore, and also that of the isthmus will continue to secrete after most of the epithelium of the cyst proper has been ~~knocked out of the running.~~ *rendered inactive.*

The distension is greatest at the ampulla for two reasons. In the first place, it is already the widest part of the tube - the diameter of the tubal cavity in the sphere of the isthmus is 2 - 4 m/m, whereas in the ampulla it is 7 - 9 m/m.¹⁰ In the second place, the plicae are most numerous in the ampulla, where the secretion, therefore, is more abundant. Accumulation, then, with a relative amount of pre-existing dilatation, in time, causes paralysis of the muscle. The paralysis causes further dilatation and thereby accumulation of contents, which again in turn mechanically promotes the dilatation.

Every case of hydrosalpinx, however, is not due to a salpingitis and several cases ¹¹⁻¹³ have been

recorded as occurring without any sign of inflammation. J. Delage¹⁴ in discussing pathogenesis, says that "the very fact that tubes affected with hydrosalpinx differ in appearance and anatomy in some cases leads one to think that the cause is not always one and the same." Experiments on animals have, moreover, conclusively proved that all that is necessary in the production of hydrosalpinx is occlusion of the fimbriated end, and Dr. Cullingworth¹⁵ has taught us that the tube may thus become occluded, usually from a localised peritonitis originating in disease in some other part of the pelvis, not infrequently in purulent inflammation of the tube of the opposite side. Mr. A. Doran¹⁶ has clearly demonstrated this perimetritic closure. The inflammatory exudation binds down and covers in the fimbriae, which adhere together and also to the surrounding structures - the ostium is thus mechanically sealed up from without.

Anything, then, which causes perimetritis, may cause this form of hydrosalpinx, such as ovarian cystoma and fibroid tumour of the uterus, which by their distension and growth set up a localised peritonitis. An instructive case is that of "M.E., married 8 years, 2 children, 6 and 4½ years respectively, and 3 abortions - the last ectopic, which was cleared out two years ago by a vaginal section. For the last 12 months

she has had much pain in the iliac region, increased on exertion. The left tube was cystic - the right which had been the seat of gestation, was shrivelled."

There can be little doubt that in this case the operation was followed by an aseptic peritonitis which sealed the ostium of the left tube, causing it to become cystic.

In this variety, as in the other, of hydrosalpinx, the secretion of the tube accumulates and causes distension.

Between these two kinds of hydrosalpinx, there are important differences. In the one there are distinct evidences of salpingitis - in the other there are no such evidences. The great difference, however, is in the fluid ; in the salpingitic form, it is serous and sometimes haemorrhagic - in the perimetritic, it is clear and watery and does not contain albumen. Much speculation has been indulged in as to why the contents of hydrosalpinges vary so much in character. The fluid is invariably spoken of as "serous", and I have been unable to discover any recorded case where it has been said to contain no albumen. Fluid No.1 (described on page 14) was carefully examined by Professor Moore and myself and shewed

not the slightest trace of albumen. It was from a perimetritic hydrosalpinx, the perimetritis being due to the presence of a large fibroid uterus. It has been variously stated that the serous fluid is due to "a low form of inflammation affecting the lining membrane of the tubes," and again, "to a slight degree of infection of the tubal mucous membrane, which would not lead to a purulent secretion, but to a serous hypersecretion, due, therefore, to transitory inflammation of the mucous membrane."

Pompe vanMeerdervoort and J. Delage¹⁷ firmly believe that there is such a thing as a real primary dropsy of the tube. All these, however, are merely hypotheses, and have had no verification. I have endeavoured to shew that albumen, when present, is invariably the effect of a preliminary salpingitis. The fluid in perimetritic cysts is the pure, natural secretion of the Fallopian tube - in salpingitic cysts, it is secretion plus a greater or less amount of serous exudate, which is sometimes haemorrhagic.

The fluid is thus sometimes rich, sometimes poor, in albumen. *And sometimes contains no albumen at all.* With the progressive growth of the swelling from constantly added secretion,

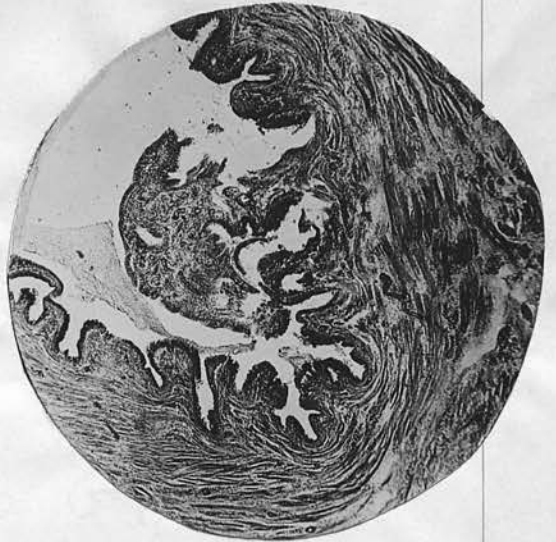
Fig.XXI.

(a)



Wall of salpingitic
hydrosalpinx
Low Power

(b)



Wall of perimetritic
hydrosalpinx
Low Power

the relative amount of albumen diminishes.

If we refer again to page 15, we find that the analysis of the fluids is most instructive :-

No.2 fluid was from a salpingitic hydrosalpinx.

It was haemorrhagic and rich in albumen - shewed total solids - 2.57% of which 2% was organic.

No.3 fluid was also from a salpingitic hydrosalpinx.

It shewed a moderate amount of albumen but no signs of haemorrhage. This, coming from a large cyst, was not rich in albumen. It contained total solids 1.511% of which .906% was organic.

No.1 fluid was from a perimetritic hydrosalpinx and contained total solids 0.78% of which .14% was organic. *No albumin was present.*

I consider the distinctions between the two varieties of cysts to be so important that I recapitulate them as follows :-

I. Salpingitic

- (a) Evidences of salpingitis e.g. small round-celled proliferation, haemorrhages, enlarged and thickened blood vessels, connective tissue cell proliferation, swollen plicae.
- (b) The fluid is amber-coloured, yellow, pale-buff, or haemorrhagic and contains albumen.

II Perimetritic

- (a) No evidences of salpingitis.
- (b) The fluid is clear and does not contain albumen.

It might be argued that Mr. Bond's experimental hydrosalpinx was analagous to a perimetritic hydrosalpinx in the human subject as a ligature was merely tied round the fimbriated extremity of the tube, and yet the fluid contained serum albumen. But in these experiments, the application of the ligature would produce a certain amount of salpingitis from mechanical injury. Some authorities have laid down that mechanical injuries do not induce inflammation, but Adami¹⁸ shews this view to be erroneous. He says :-

"Even the simplest fracture of a bone is followed
 "by dilatation of the vessels of the surrounding
 "parts, by exudation, diapedesis of leucocytes.....
 "While at first it might appear an easy matter to
 "have case after case where the irritant has but
 "a momentary action, upon further consideration,
 "it is found that, in the majority of cases of
 "purely mechanical injury, this is not the case,
 "or to express the matter more exactly, in the
 "case of physical injuries, it is not the act of
 "wounding that causes the inflammation, but the
 "damage inflicted upon the cells of the tissues;
 "as to a very large extent, inflammation is ~~not~~
 "set up by the products of the injured and destroyed

"cells. A bone may be suddenly broken, and never-
 "theless, even in the most favourable circumstances,
 "pain, swelling and congestion may affect the region
 "of fracture for several days."

It is convenient here to notice the albumens
 which are present in some hydrosalpinx fluids :
 they are serum albumen, serum globulin, and albumoses.
 The first two are the ordinary albumens found in
 inflammatory exudate ; the albumoses are the results
 of digestion, the ferments being developed from the
 19.
 cells of the exudate.

Other points :-

Relation of hydrosalpinx to haematosalpinx

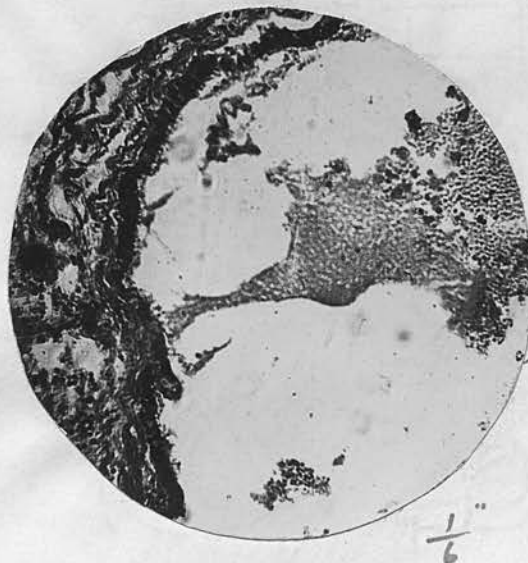
It is asserted that most cases of haematosal-
 pinx are really gravid tubes.²⁰ Possibly in the major-
 ity of cases this is so - there are others, however,
 in which there are no evidences of gestation, and
 which cannot be put down to this cause. How are
 they to be accounted for? The tubes do not menstru-
 ate, and menstrual blood cannot regurgitate from
 21.
 the uterus. Even in the "broad atresias of Herman"²²,
 when a haematometra is the result of inflammation,
 and the Fallopian tubes are sometimes filled with
 blood, such filling of the tubes is not mechanical,

but as this author has pointed out, is due to the pelvic congestion of menstruation causing bleeding in the already inflamed oviducts, the inflammatory process having closed the ostia. I have tried to shew how haemorrhage may also occur in a tube, as the result of an acute salpingitis, the haemorrhage taking place by diapedesis and forming a blood cyst.

It is important to note that in these blood cysts the epithelium of the mucosa is not destroyed, and it is not difficult to see how such a cyst may develop into a hydrosalpinx. Changes take place in the effused blood - it becomes dark and treacly from separation and conversion of the pigment, and is progressively thinned and clarified. At the same time, it is "watered" by the addition of the clear, saline secretion of the mucosa, till, in course of time, we have an amber coloured, pale-buff or almost colourless liquid. The haemorrhagic character of the fluid in some hydrosalpinges is thereby explained, some observers giving the compound name of hydro-haemato-salpinx to these cysts. The results of the degen-

eration of the blood are to be seen in blood crystals, crystals of cholesterin, broken up corpuscles and blood plates, and granular detritus, and all these have been found in the contents of some cysts.

Figure 22 is a microphotograph of a section



of a tube removed from a patient, Mrs.C. aged 31. The tube was covered with adhesions, the abdominal ostium closed, and the lumen filled with dark blood resembling menses. The opposite tube was converted into an abscess cavity, and contained creamy-yellow pus. The wall shewed considerable

round celled infiltration and haemorrhages. It will be seen that the epithelium is still intact, and in the lumen are small, loose coagula containing red and white blood corpuscles.

Cases like the above are not often seen, because they do not come into the hands of gynaecologists until either suppuration has occurred, or the cyst has developed into a hydrosalpinx and caused pain by its distension and growth. In this particular case, it was the pyosalpinx which gave rise to the greatest distress.

It has been stated by Mr. Clement White²³ that "there is no difficulty in assuming that a hydro-salpinx may become a haematosalpinx by haemorrhage from the inflamed wall taking place into it." I consider it is with the greatest difficulty we can accept such a theory as the vessels suffer from the pressure of the contained fluid and are not likely to rupture. Moreover, when the tube has been inflamed, the vessels are thick walled and are supported by thickened connective tissue. In the specimen described on page 13, as shewing recent haemorrhages near the ostium, the haemorrhage must have been due to one of two things. (1) Grasping of the cyst wall by

the operator during removal, or (2) to the fact that the leakage had caused a "buckling" of the wall, and rupture of the small capillaries. The former I regard as being the more probable cause, as the cyst had to be removed from adherent surroundings.

There are certain important distinctions between haematosalpinges from ectopic gestation, and those which arise from acute salpingitis - they are :-

Due to ectopic gestation

²⁴

1. The tube is nearly always open, shewing that there has not been previous inflammation.

²⁵

2. Shew chorionic villi or other signs of gestation.

3. The blood is clotted.

Due to acute salpingitis

1. The tube invariably shews signs of inflammation and is closed

2. Shew no signs of gestation.

3. The blood remains fluid.

Relation of hydrosalpinx to pyosalpinx

²⁰

Mr. Bland-Sutton believes that there is a form of pyosalpinx which becomes slowly and passively dilated with fluid and transformed into a hydrosalpinx. The reasons he gives are five in number,

and I will criticise them as I go on.

1. "Hydrosalpinx is not found in acute cases"

This is no reason at all. As I have shewn, operation is not undertaken after an attack of pelvic inflammation but only after the hydrosalpinx has attained some growth and can be diagnosed. Small specimens are generally removed with fibroid or carcinomatous uteri.

2. "In many chronic cases, hydrosalpinx is found on one side of the uterus and a progressive pyosalpinx on the other"

But both may be due to one cause, for instance, an inflammation of the endometrium spreading to both tubes. On the one side, hæmorrhage may result from the salpingitis, and blood, being a dead tissue and thus an excellent medium for putrefaction, suppuration ensues, and the epithelium of the mucosa is destroyed. In the opposite tube, the exudation may or may not be hæmorrhagic. Suppuration does not ensue, and the epithelium not being destroyed, the secretion of the tube accumulates. The same cause may produce a bilateral or unilateral hydrosalpinx, or a hydrosalpinx on one side and a

pyosalpinx on the other.

On the other hand, a hydrosalpinx may originate from a perimetritis, due to a pyosalpinx of the opposite tube.^{26.}

When a pyosalpinx attains a large size, it is most probably of tubercular origin.^{27.}

3. "The ampulla of a tube may be dilated into a hydrosalpinx and the isthmus contain pus."

Personally, I have never seen this. I have also asked several gynaecologists if they have ever come across such a condition and have invariably received a reply in the negative.

4. "The fluid contained in a hydrosalpinx will sometimes be colourless, but the recesses of the tube contain caseous material and cholesterin."

This "caseous" material is, however, most likely the degenerated remains of clusters of blood corpuscles, or what is still more probable, a mass of thrown off epithelial cells which have undergone colloid degeneration.^{See Fig VII.} The presence of cholesterin does not necessarily indicate pus ; it

is also found in haemorrhagic effusions, as the result of chemical changes.

5. "The dilated portion of the tube in hydrosalpinx may, as in pyosalpinx, communicate with an enlarged ovarian follicle to form a tubo-ovarian cyst."

We cannot infer from this that the one condition follows the other. Both may be due to a similar cause, and the course of the disease is the same in both up to a certain stage.

The same observer has stated that the inner wall of a sac which has been converted from a pyosalpinx to a hydrosalpinx, occasionally bears papillomata. I very much fear that these so-called papillomata are in reality the flattened, knobby plicae met with in salpingitic hydrosalpinges.

When pus degenerates, it is more in the direction of caseation or calcification. Caseous material and calcareous nodules have both been found in pyosalpinx.

43.
Fig.XXIII.



Photograph of large pyosalpinx, shewing caseous material on the inner wall.

From the Gynaecological Museum, Liverpool University.

Apart from the contents, there is one very great difference between hydro- and pyosalpinx. In the former, the epithelium persists to the very last moment - it may be crushed and flattened almost out of recognition but is always present at some or other part, if not all, of the wall of the cyst. In pyosalpinx, on the other hand, it is destroyed comparatively early, the tube becoming converted into an abscess cavity and the

mucosa replaced by granulation tissue.²⁸

Some observers are of the opinion that the opposite sequence may occur, that is, that a hydro-salpinx may become infected and be transformed into a pyosalpinx. No evidence has been adduced in favour of this, and however plausible such a view may seem, it is difficult to conceive it as being possible. Granted that microbic invasion might take place into a practically closed cavity, the fluid would have the effect of diluting the irritant to such an extent as to render it comparatively harmless.

C O N C L U S I O N S

1. Hydrosalpinx is a disease of married life
2. It is most common between the ages of 30 and 40.
3. In 50% of the cases, it is bilateral.
4. Puerperal endometritis is the most frequent cause, gonorrheal endometritis being only half as common. It is often met with as an accompaniment of pathological growths of the uterus.
5. Sometimes there is no communication between the cyst and the uterus.
6. The epithelium of the mucosa persists.
7. The fluid is usually albuminous, but sometimes non-albuminous.
8. The albumen, when present, is the result of a preliminary salpingitis which gives rise to serous exudation.
9. There are two kinds of hydrosalpinx
 - (a) the salpingitic
 - (b) the perimetritic.
10. The salpingitic variety always shews signs of old inflammation in the walls of the cyst and the fluid is albuminous.
11. The perimetritic variety shews no signs of inflammation of the wall and the fluid is non-albuminous.
12. The hæmorrhagic character of some fluids is to be explained by the preliminary hæmorrhagic exudate of an acute salpingitis.
13. Haematosalpinx is thus sometimes an effect of acute salpingitis, and develops into (a) a hydrosalpinx or (b) a pyosalpinx.
14. Pyosalpinx does not become converted into hydrosalpinx and it is exceedingly improbable for the opposite sequence to occur.

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